

Barrel TOF Mechanics

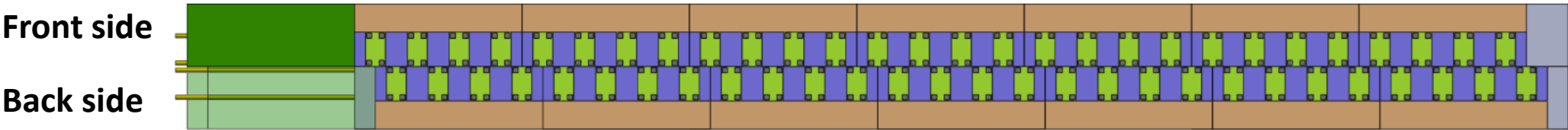
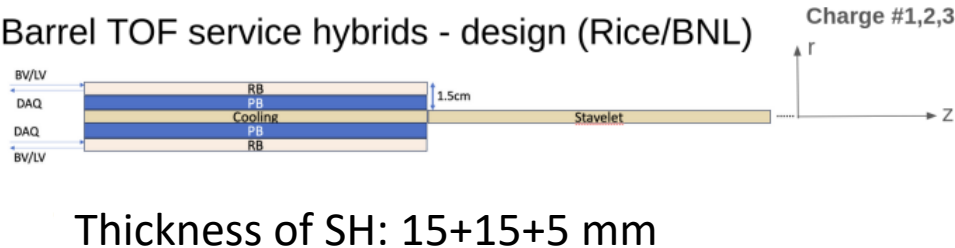
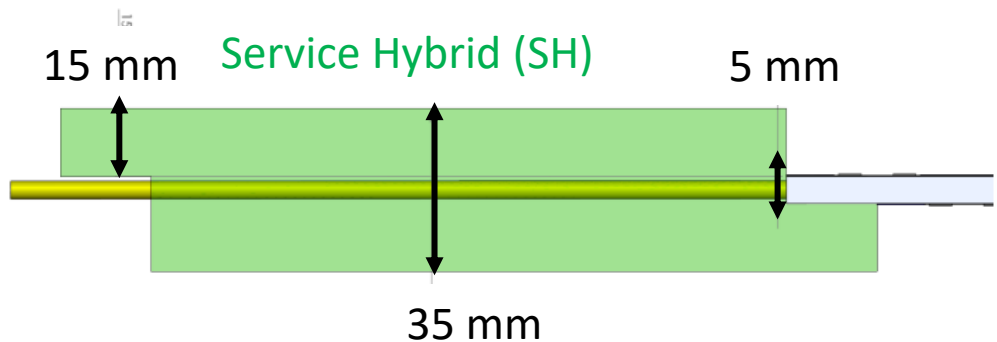
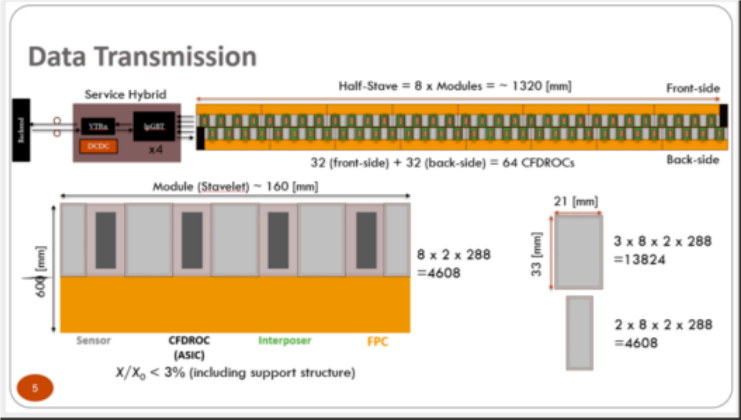
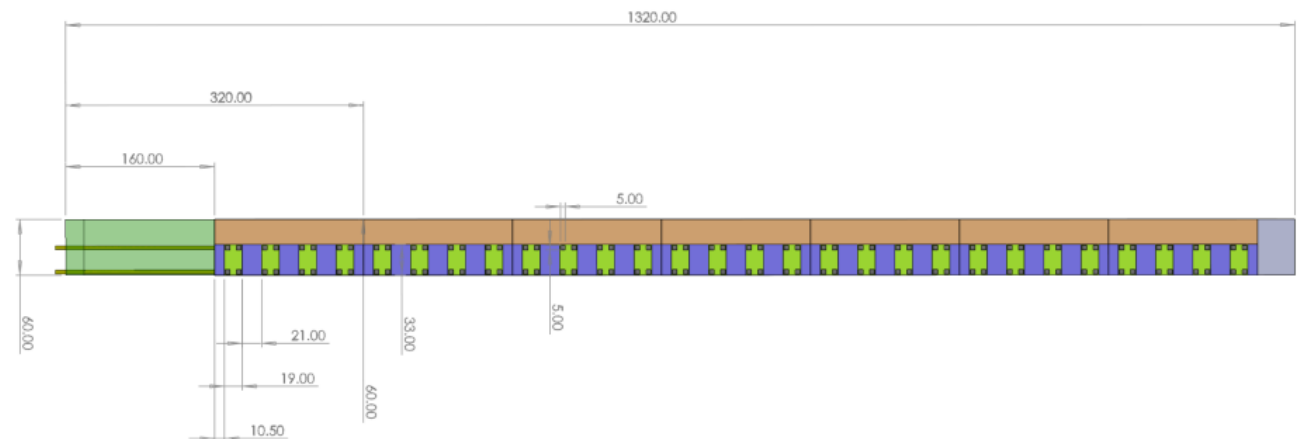
Han-Sheng Li, Anish Tilad, Andreas Jung,
Yuvraj Chauhan, Sushrut Karmarkar

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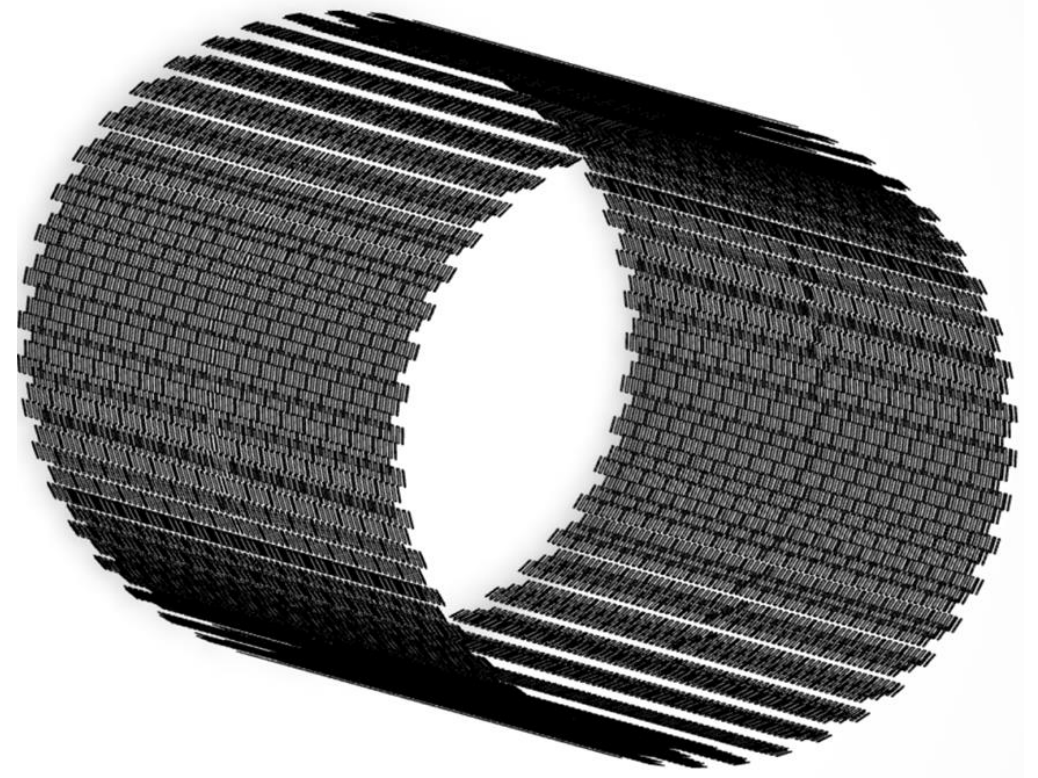
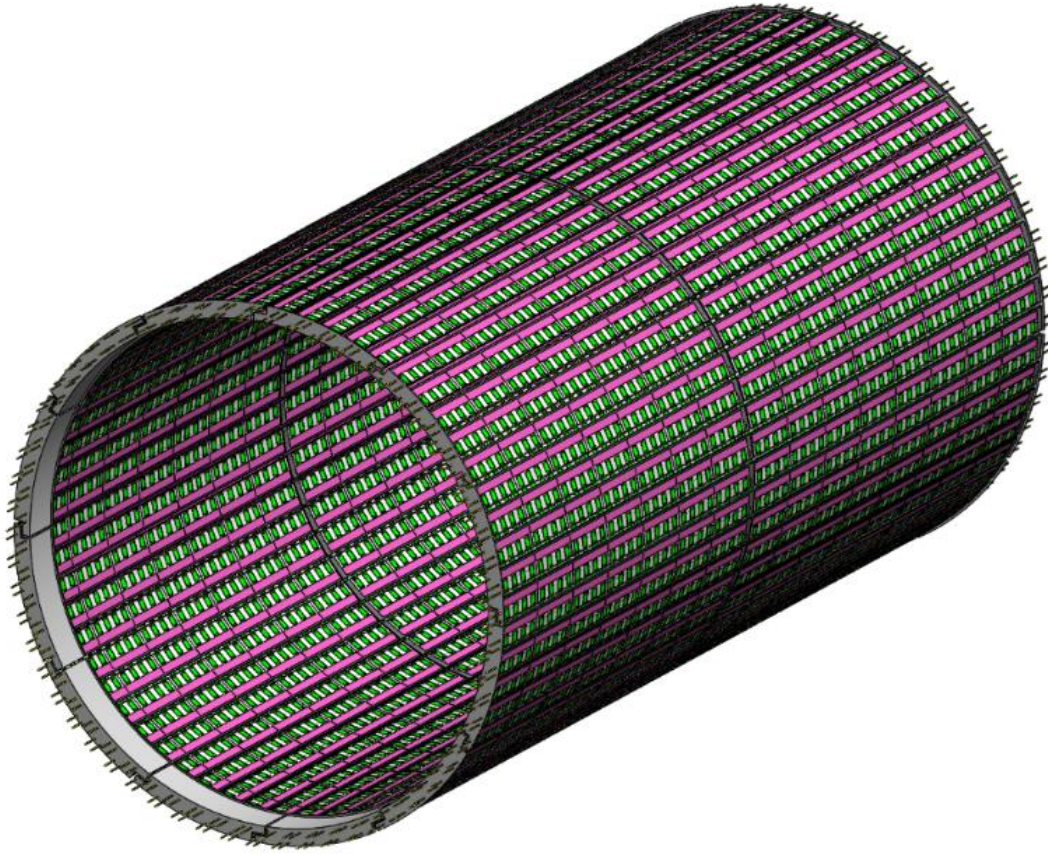
Barrel TOF Mechanical Design

Single stave



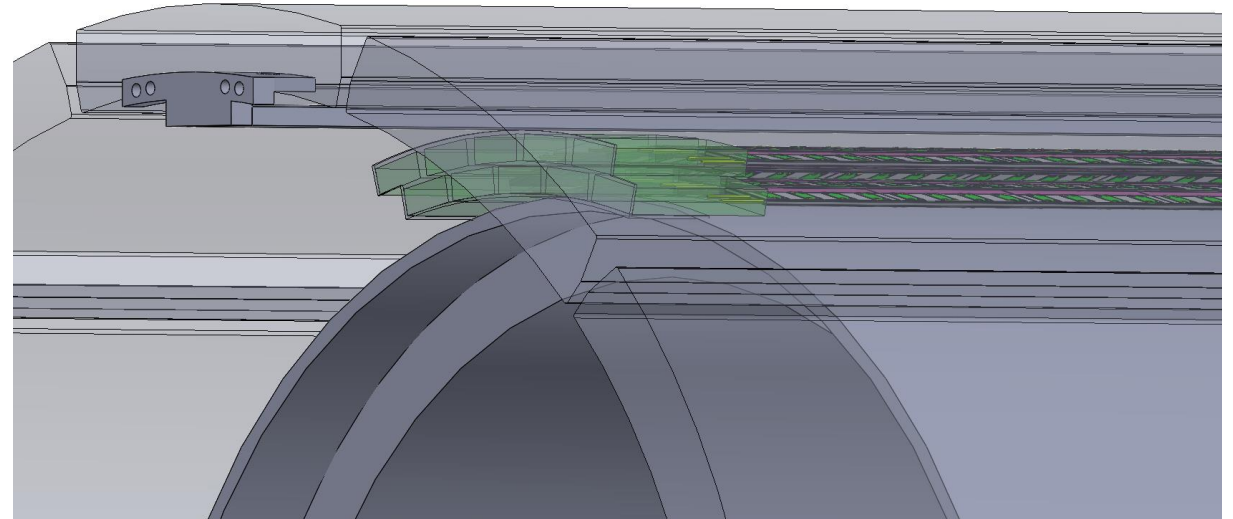
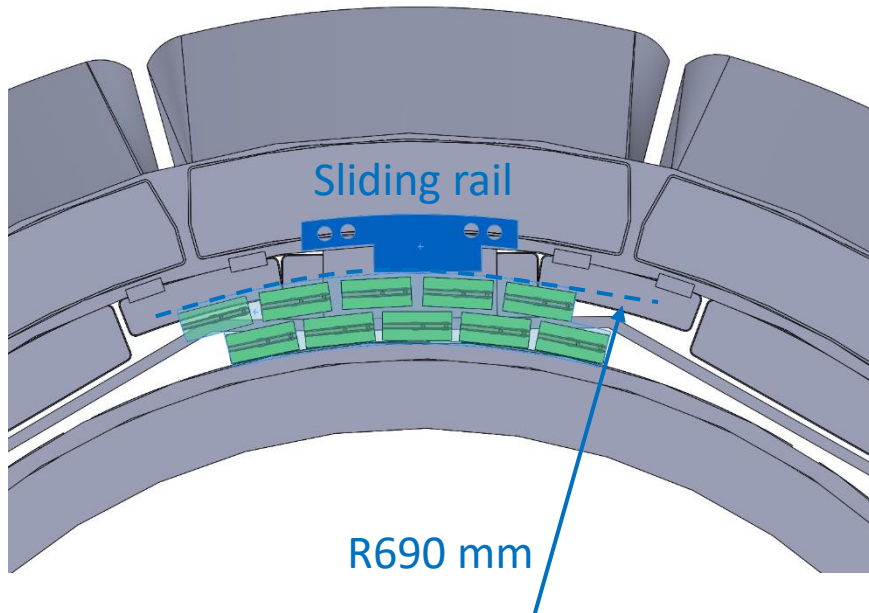
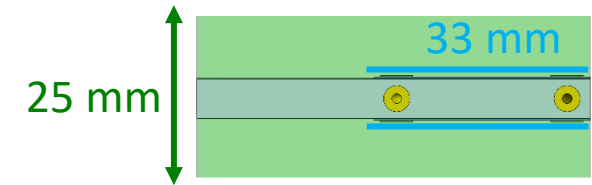
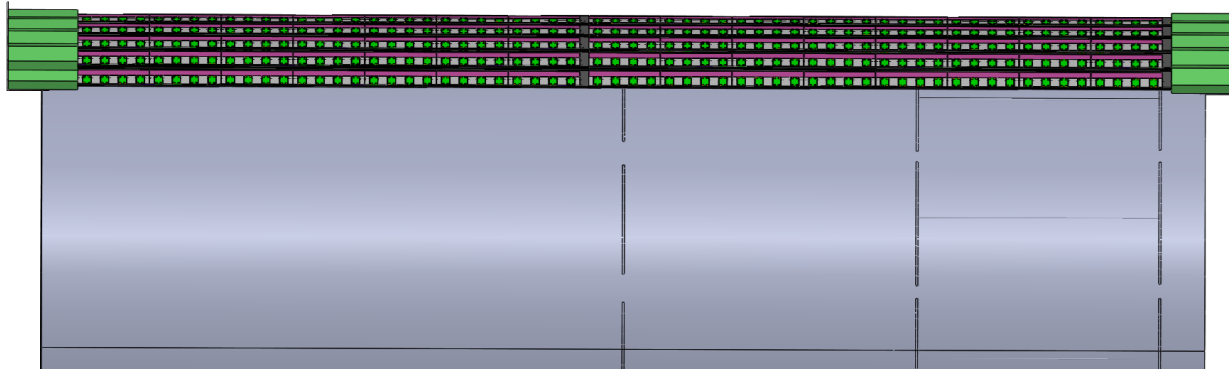
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- Silicon sensor coverage



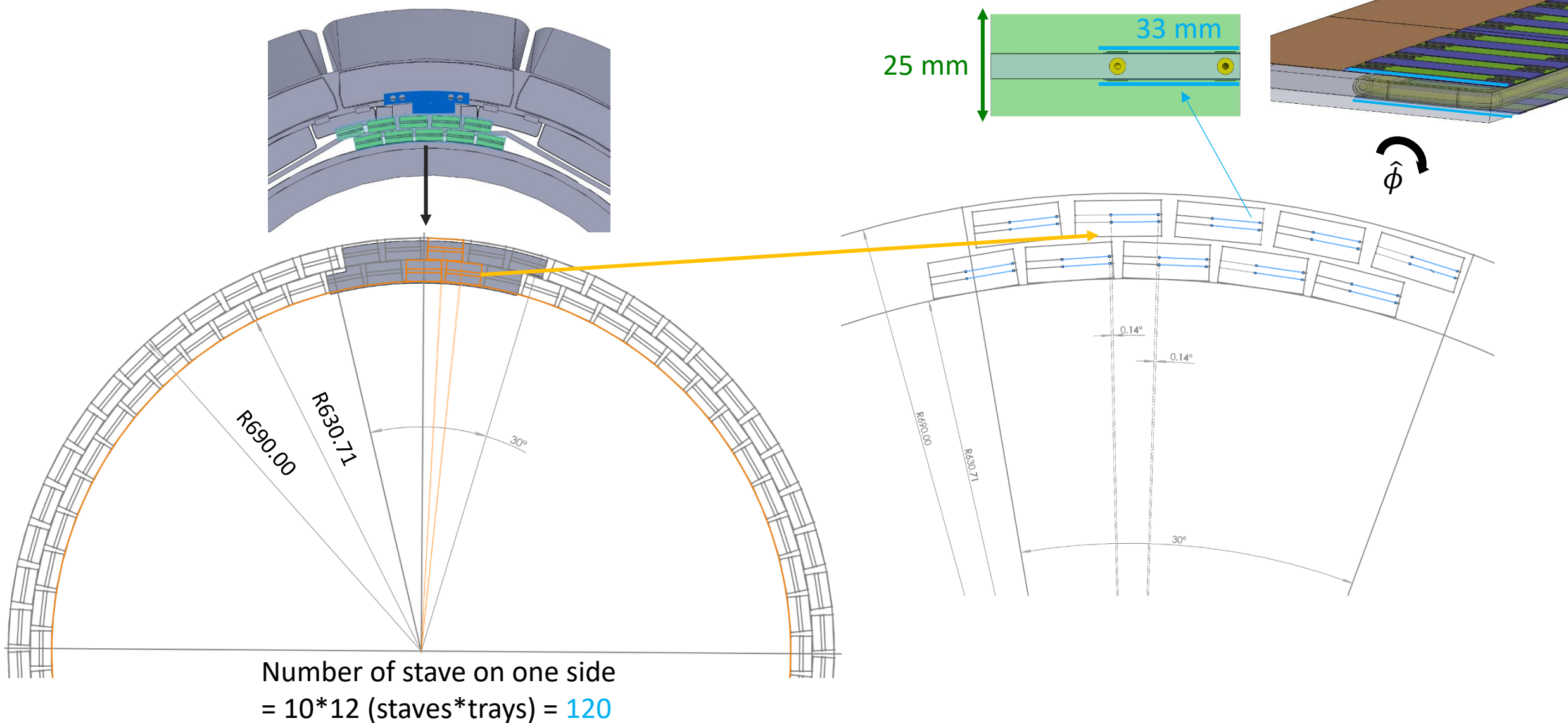
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■ 2-layer design in the Envelope



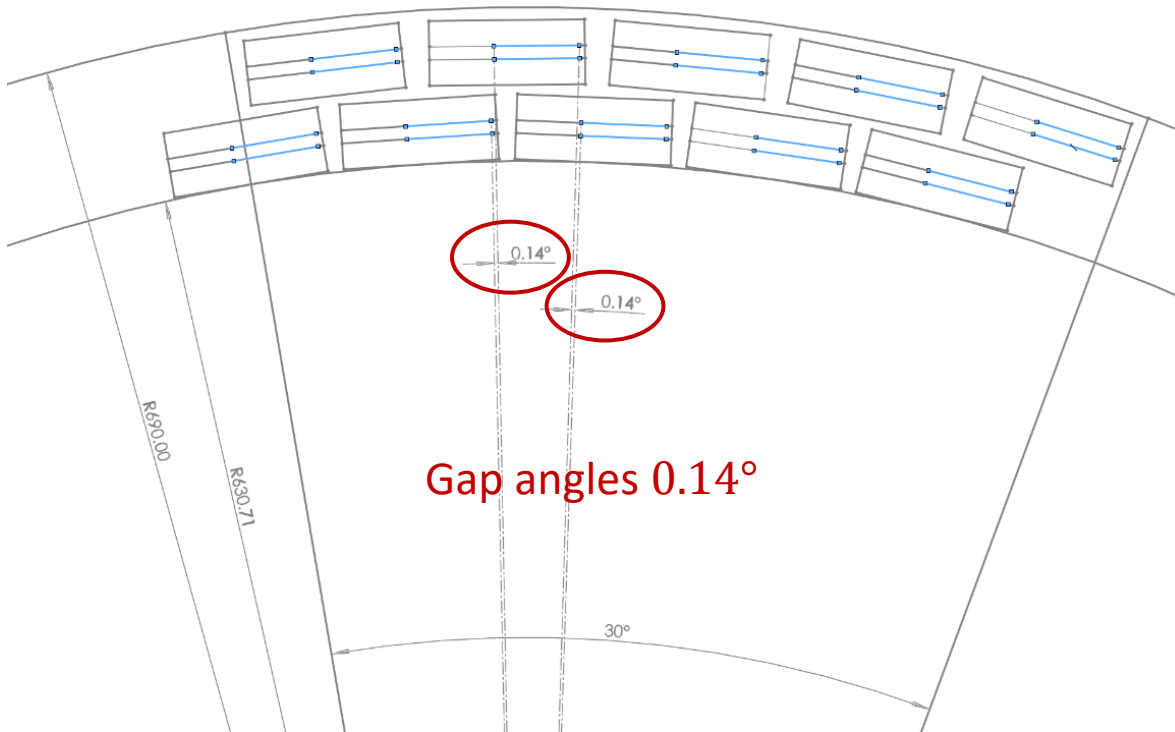
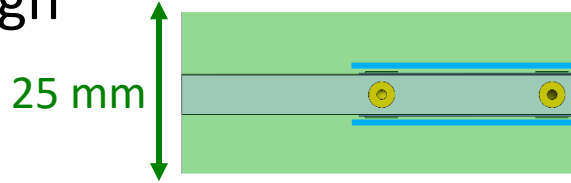
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■ 2-layer design on $r - \phi$ plane



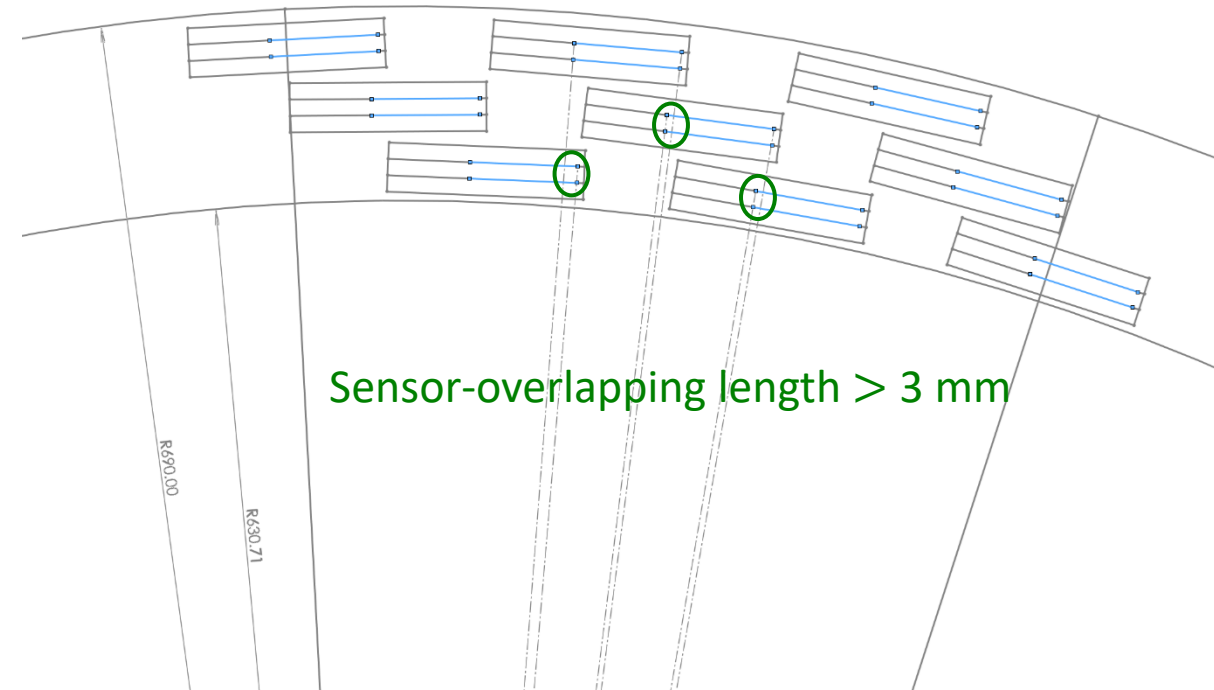
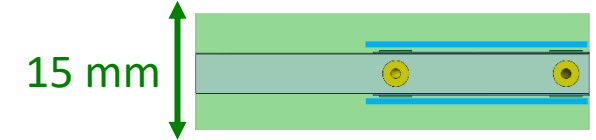
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■ 2-layer design



- Sensors do **NOT overlap** in ϕ direction
- Overall acceptance on $r - \phi$ plane is **95.3%**
- Thickness of Service Hybrid is **25 mm**

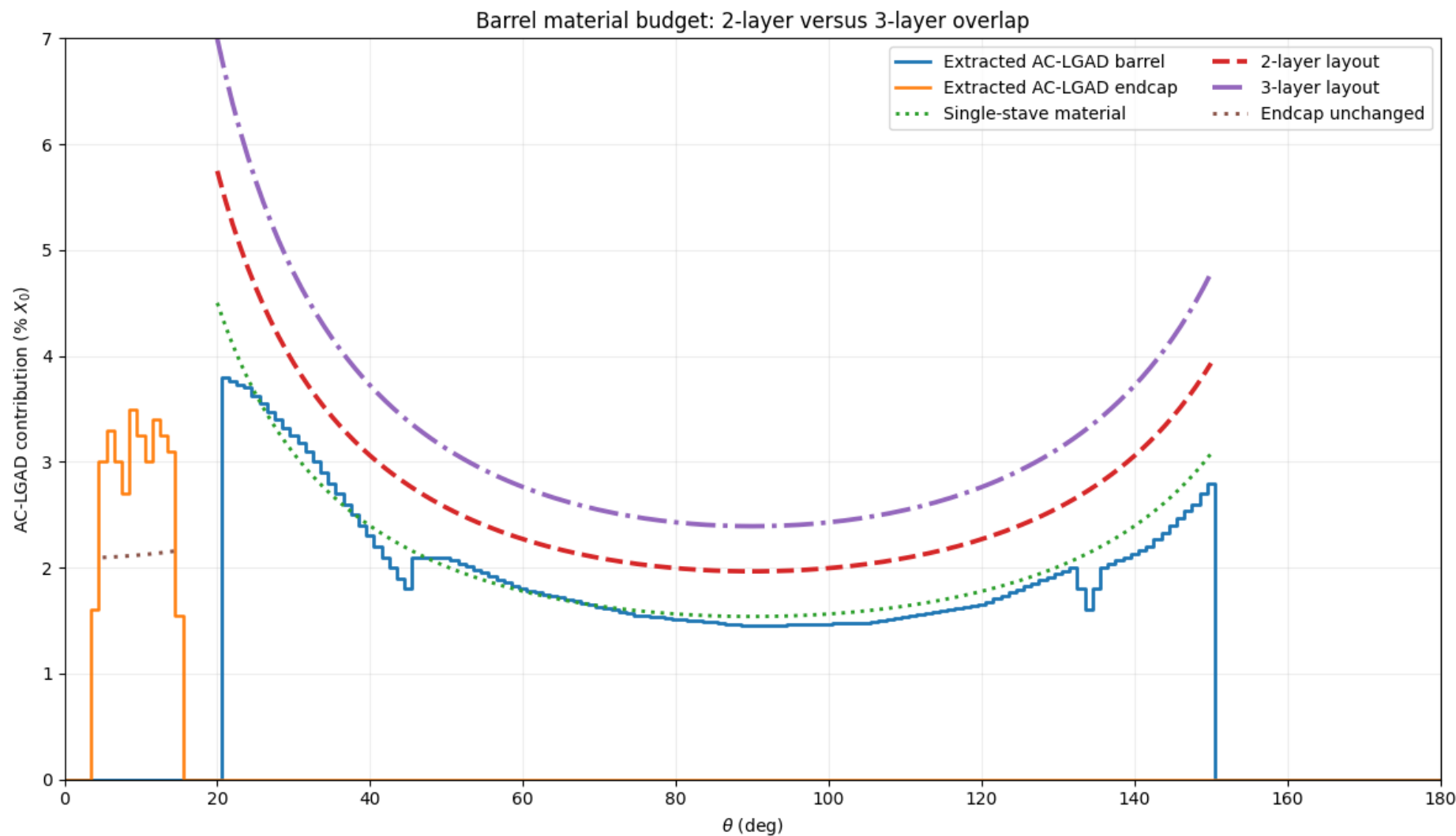
■ 3-layer design



- Sensors overlap in ϕ direction
- Overlapping lengths more than **3 mm**
- Overall acceptance is 100 %
- Thickness of Service Hybrid is **15 mm**

Barrel TOF Mechanical Design

■ Material budget estimation



Summary

■ Target of the design

- ❑ Avoid requiring a thinner thickness of Service Hybrid (current design 35 mm)
- ❑ Larger acceptance
- ❑ Smaller material budget

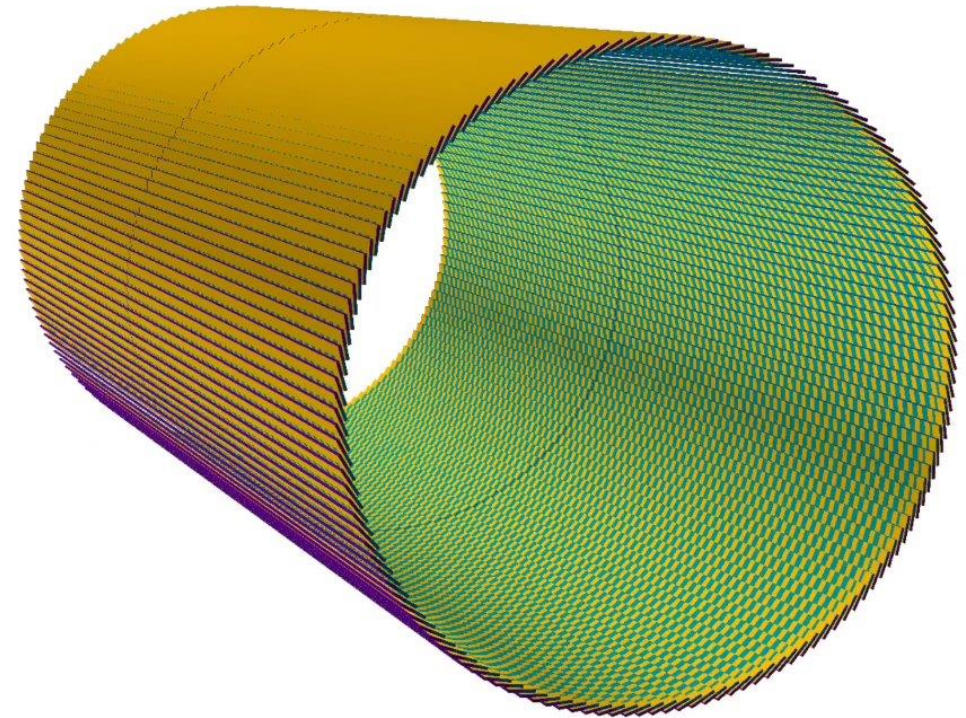
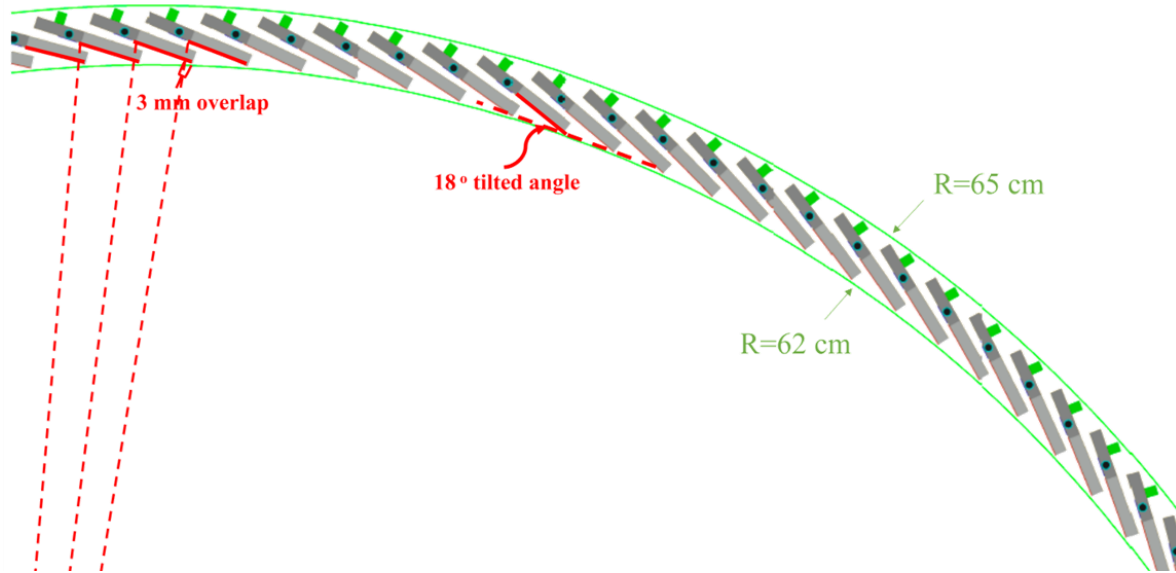
	Sensor-overlapping length	Acceptance	Demand of SH thickness	Number of staves on one side	Material Budget
Old tilted layout	> 3 mm	100 %	5 mm	144	< 3 %
2-layer	None	95.3 %	25 mm	120	~ 3 %
3-layer	> 3 mm	100 %	15 mm	138	> 3 %

Conclusion for the comparison:

2-layer design has only acceptance 95.3 % but avoid requiring a thinner thickness of SH, and has material budget ~ 3 %

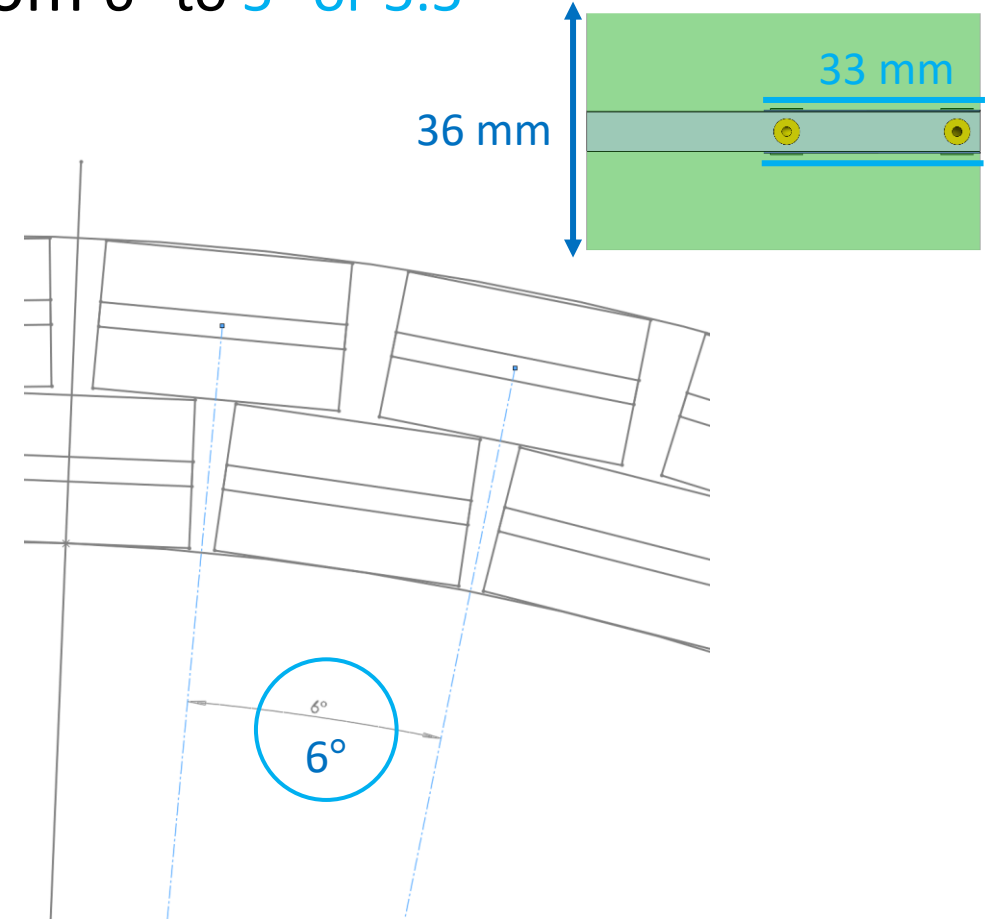
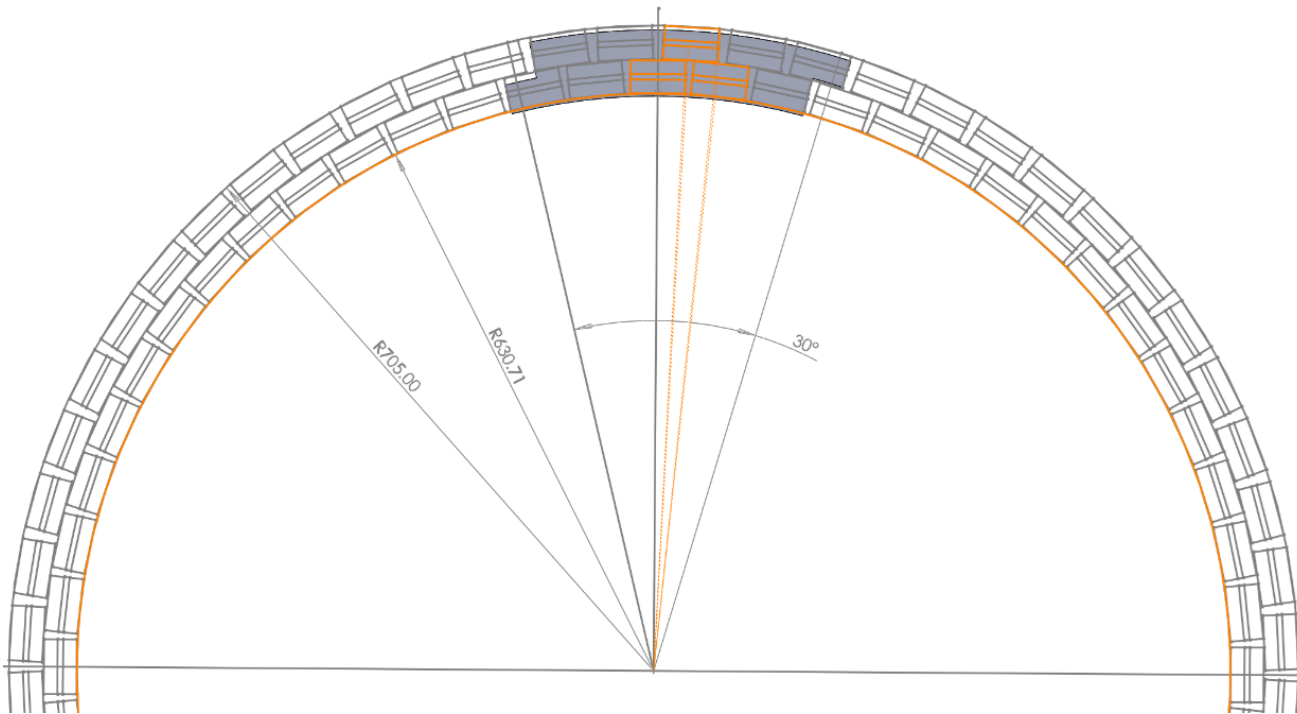
Backup

bTOF tilted tessellation array



What are potential solutions? — Reduce Opening Angle

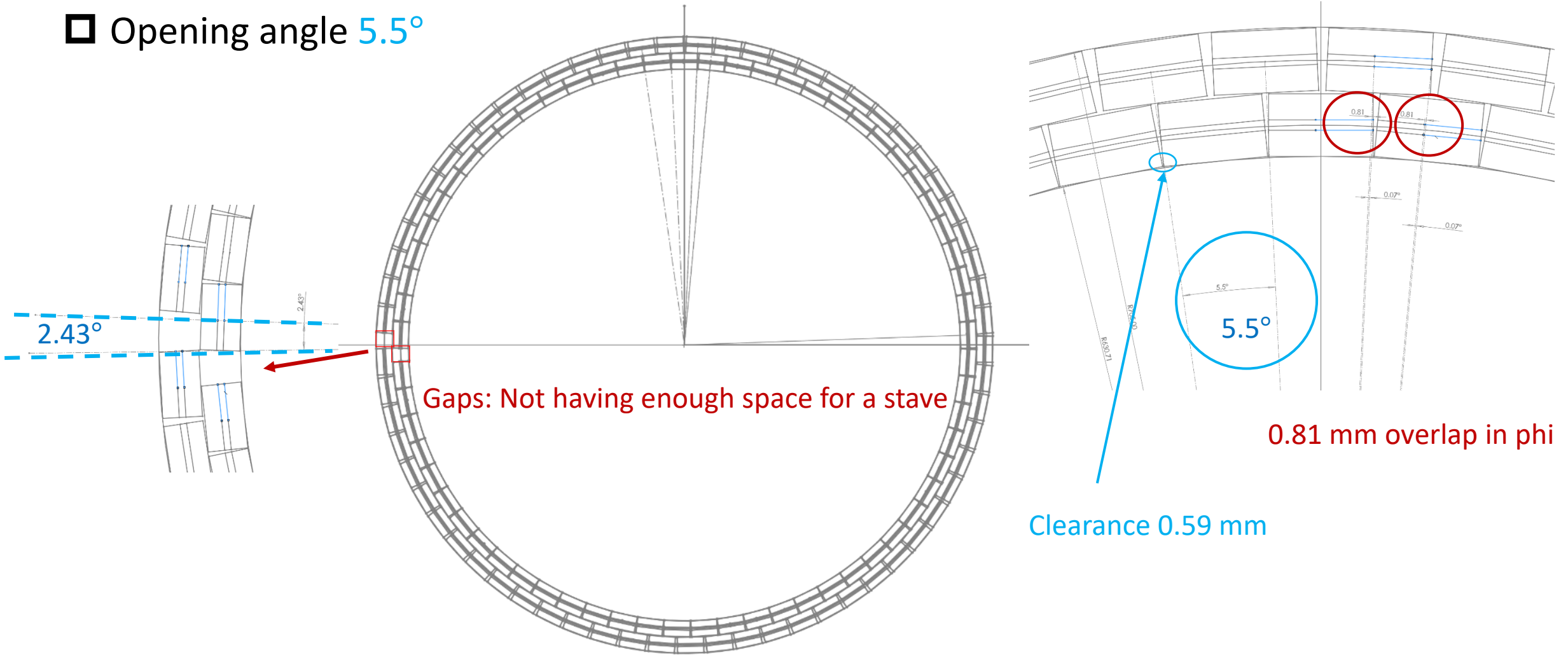
- Reduce the opening angle between staves from 6° to 5° or 5.5°
- Current design: Opening angle 6°



- Number of staves = $(360/6) * 2 = 120$ staves on one side
- Number of sensors = $120 * 7 * 4 * 2 = 6720$ sensors

What are potential solutions? — Reduce Opening Angle

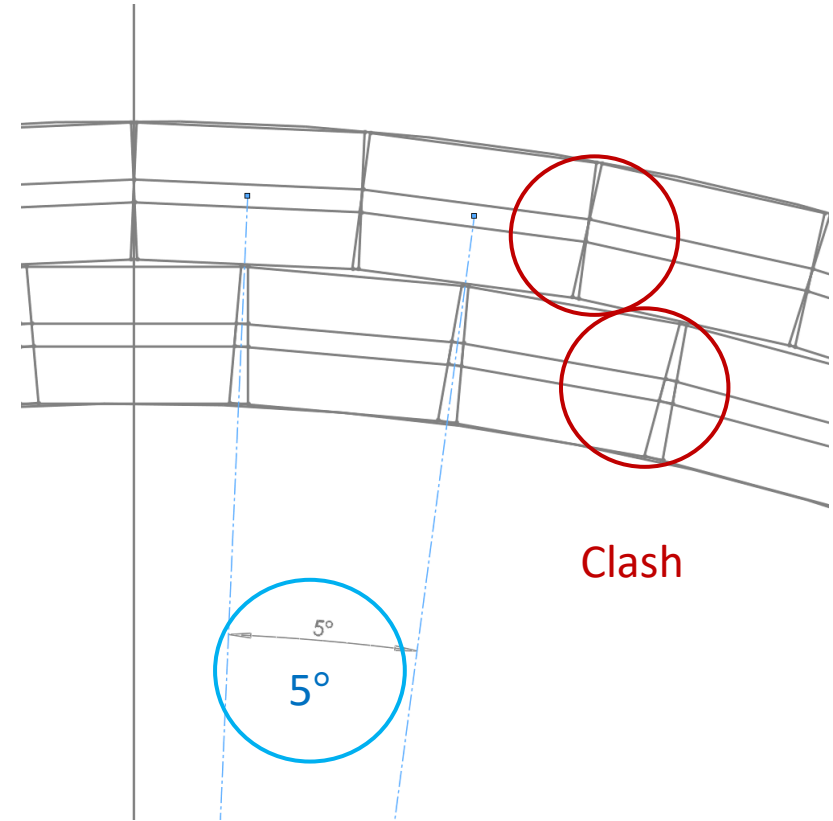
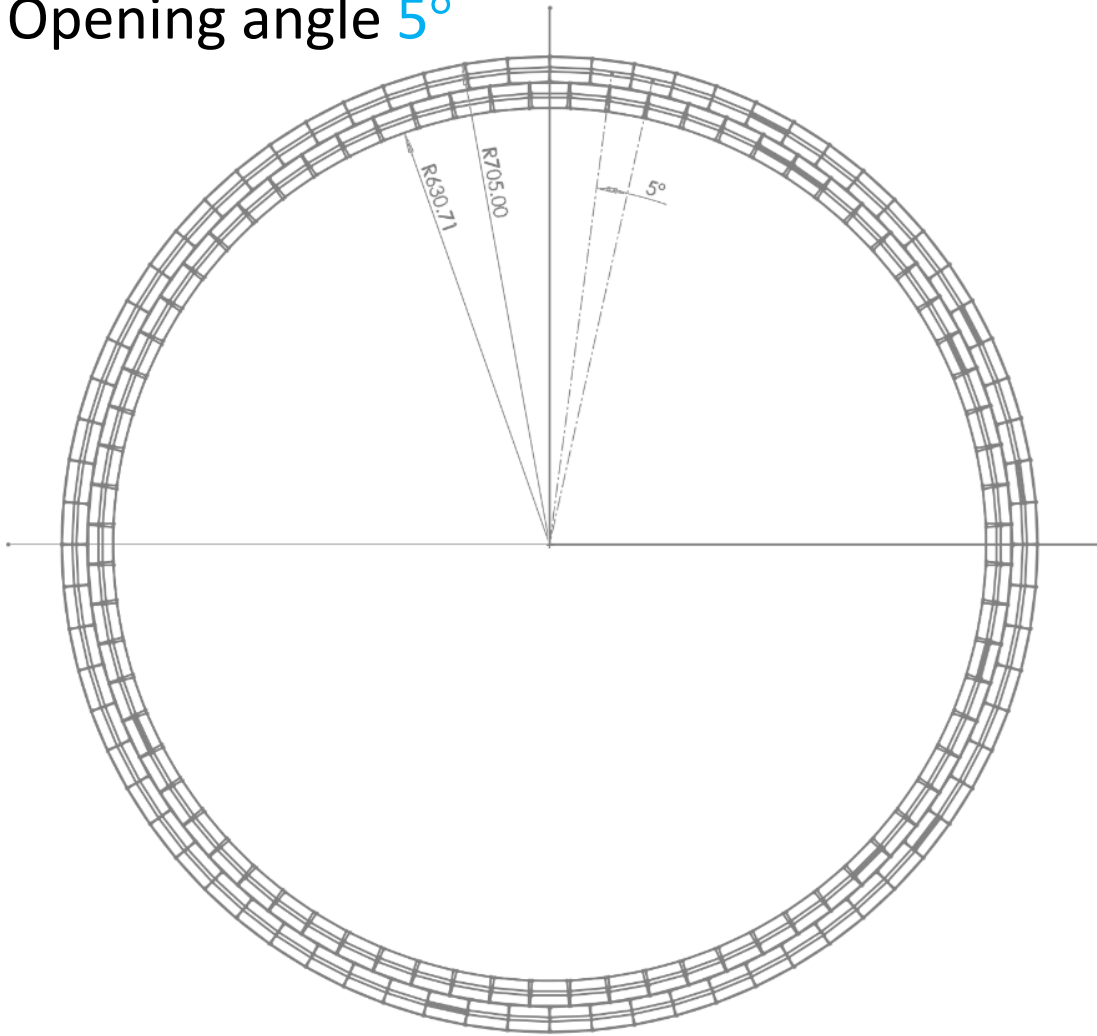
□ Opening angle 5.5°



- Number of staves = $(360/5.5)*2 = 130.9$ staves on one side
- Number of sensors = $130.9*7*4*2 = 7330.4$ sensors

What are potential solutions? — Reduce Opening Angle

□ Opening angle 5°

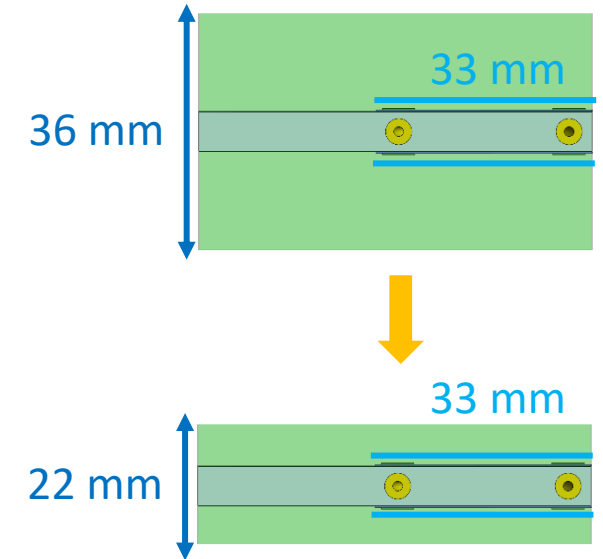
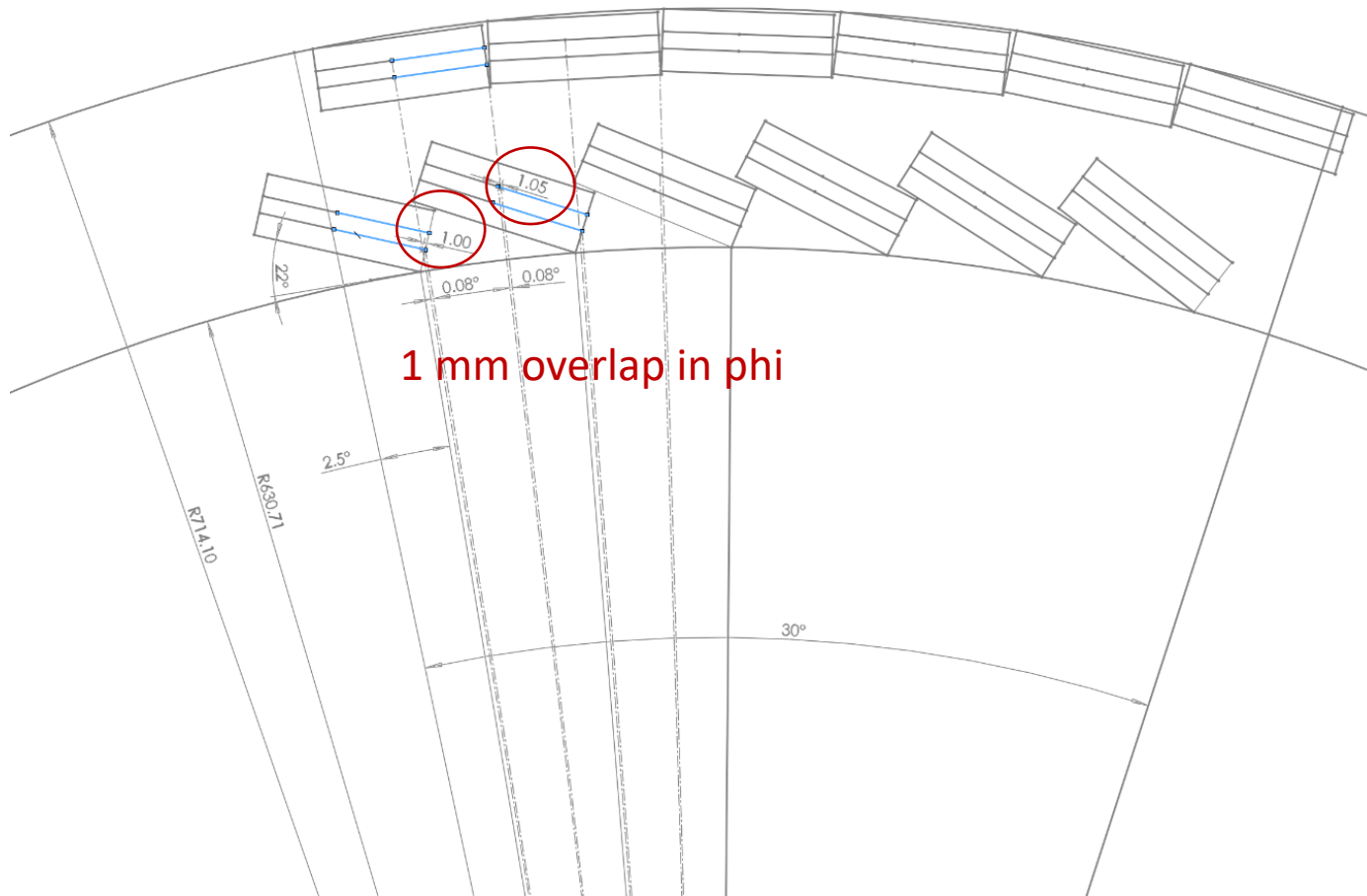


- Number of staves = $(360/5)*2 = 144$ staves on one side
- Number of sensors = $144*7*4*2 = 8064$ sensors

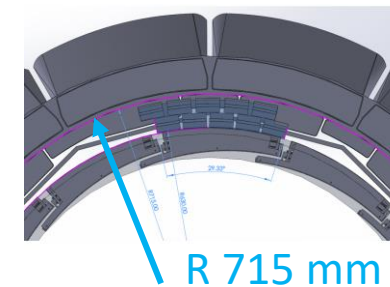
What are potential solutions? – Rearrangement of Staves and Redesign Service Hybrid

■ Rearrange staves on TOF tray

- Arrangement 1 (2 rows, 6 staves on upper row, 6 lower row, 12 staves in a tray)



- To have the round arrangement on upper row within outer radius 715 mm, the thickness of Service Hybrid is reduced from 36 to 22 mm, if not the interference occurs.



What are potential solutions? – Rearrangement of Staves and Redesign Service Hybrid

- Arrangement 2 (3 rows, 4 staves on upper row, 4 middle, and 4 lower, 12 staves in a tray)

